CLAIMS

1. A method of treating tumors or cancer in a human in need of such treatment, which comprises:

(a) administering to the human a transfer compound which comprises a chemotherapeutic compound linked to a carrier compound by a bond or a bridging molecule, said carrier compound, bridging molecule or chemotherapeutic compound comprising a pre-selected element; and then

(b) irradiating a selected region, in which tumorous or cancerous cells are located, with line emission x-rays of an energy selected to cause emission of Auger electrons from said pre-selected element in a dose effective to disrupt the linkage to said chemotherapeutic compound and thereby release said chemotherapeutic compound in proximity to said cancerous cells.

2. A method according to claim 1, wherein the transfer compound is substantially non-toxic.

3. A method according to claim 1, wherein the transfer compound has an affinity for both normal and cancerous cells.

4. A method according to claim 3, wherein the transfer compound is substantially non-toxic.

5. A method according to claim 1, wherein the transfer compound has a selective affinity for cancerous cells.

6. A method according to claim 1, wherein the carrier compound is substantially non-toxic.

7. A method according to claim 1, wherein the carrier compound has a selective affinity for cancerous cells.

8. A method according to claim 7, wherein the carrier compound comprises a tumor receptor ligand.

9. A method according to claim 1, wherein the carrier compound is a complex of a ligand and said pre-selected element.

10. A method according to claim 9, wherein the ligand is selected from the

group consisting of 10-(2-hydroxy-propyl)-1,4,7,10-tetraazacyclododecane-1,4,7-triacetic acid, diethylenetriamine pentaacetic acid or diethylenetriamine pentaacetic acid bismethylamide.

11. A method according to claim 1, wherein the carrier compound is a chelate.

12. A method according to claim 11, wherein the chemotherapeutic compound is covalently linked to a reactive carboxyl group of the chelate.

13. A method according to claim1, wherein the chemotherapeutic compound is a taxane.

14. A method according to claim 13, wherein the taxane is paclitaxel.

15. A method according to claim 13, wherein the taxane is a paclitaxel analog.

16. A method according to claim 13, wherein the carrier compound is a gadolinium containing chelate.

17. A method according to claim 13, wherein the carrier compound is a tumor receptor ligand comprising said pre-selected element.

18. A method according to claim 1, wherein step (b) is performed on cells removed from the human.

19. A method according to claim 18, wherein after step (b) is performed, the removed cells are returned to the human.

20. A method according to claim 18, wherein after step (b) is performed, the removed cells are transplanted.

21. A method according to claim 1, wherein step (a) and step (b) are performed on cells removed from the human.

22. A method according to claim 21, wherein after step (b) is performed, the removed cells are returned to the human.

23. A method according to claim 21, wherein after step (b) is performed, the removed cells are transplanted.

24. A method according to claim 1, wherein the pre-selected element has an atomic number in the range of from 35 to 79.

25. A method according to claim 24, wherein the pre-selected element is

selected from the group consisting of Ru, I, Gd and Pt.

26. A method according to claim 24, wherein the cancerous cells of the human's body are superficial and the pre-selected element is Br.

27. A method according to claim 1, wherein the transfer compound is selected to have a high rate of excretion by normal physiological processes.

28. A method according to claim 1, wherein the transfer compound is selected for stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the transfer compound.

29. A method according to claim 1, wherein the carrier compound is selected to have a high rate of excretion by normal physiological processes.

30. A method according to claim 1, wherein the carrier compound comprises said pre-selected element and the carrier compound is selected for stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the carrier compound.

31. A method according to claim 1, wherein an end window transmission x-ray tube producing bright line emission x-rays is used for irradiating.

32. A method according to claim 31, wherein an e-beam generated in the x-ray tube is focused on a thin target having a thickness of up to about 40 μm, said target being inside the tube and functions as part of the end window.

33. A method according to claim 32, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the K-absorption edge of the pre-selected element.

34. A method according to claim 33, wherein the thin target is selected from the group consisting of Mo, Ag, La, Sr and Tm.

35. A method according to claim 32, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the L-absorption edge of the pre-selected element.

36. A method according to claim 35, wherein the thin target is Rb.

37. A method according to claim 1, wherein Auger electrons are released with

a dose of at least about 10^6 Gy.

38. A method according to claim 37, wherein the dose of at least about 10^6 Gy is released within a distance from the pre-selected element of up to about 10 angstroms.

39. A method according to claim 1, wherein step (b) is repeated at least once.

40. A method according to claim 39, wherein Auger electrons are released during each repetition of step (b) with a dose of at least about 10^6 Gy.

41. A method according to claim 40, wherein the dose of at least about 10^6 Gy is released within a distance from the element of the carrier compound of up to about 10 angstroms.

42. A method of treating cancer in a human in need of such treatment, which comprises:

(a) administering to the human a transfer compound which comprises a chemotherapeutic compound linked to a carrier compound by a bond or a bridging molecule, said carrier compound, bridging molecule or chemotherapeutic compound comprising a pre-selected element selected from the group consisting of Br, Ru, I, Gd and Pt; and then

(b) irradiating at least once, by means of an end window transmission x-ray tube, a selected region, in which cancerous cells are located, with line emission x-rays of an energy selected to cause emission of Auger electrons from said pre-selected element in a dose effective to disrupt the linkage to said chemotherapeutic compound and thereby release said chemotherapeutic compound in proximity to said cancerous cells, said dose for each activation of said x-ray tube being at least about 10^6 Gy within a distance from the pre-selected element of up to about 10 angstroms.

43. A method according to claim 42, wherein the transfer compound is substantially non-toxic.

44. A method according to claim 42, wherein the transfer compound has an affinity for both normal and cancerous cells.

45. A method according to claim 44, wherein the transfer compound is

substantially non-toxic.

46. A method according to claim 42, wherein the transfer compound has a selective affinity for cancerous cells.

47. A method according to claim 42, wherein the carrier compound is substantially non-toxic.

48. A method according to claim 42, wherein the carrier compound has a selective affinity for cancerous cells.

49. A method according to claim 48, wherein the carrier compound comprises a tumor receptor ligand.

50. A method according to claim 42, wherein the carrier compound is a complex of a ligand and said pre-selected element.

51. A method according to claim 50, wherein the ligand is selected from the group consisting of 10-(2-hydroxy-propyl)-1,4,7,10-tetraazacyclododecane-1,4,7-triacetic acid, diethylenetriamine pentaacetic acid or diethylenetriamine pentaacetic acid bismethylamide.

52. A method according to claim 42, wherein the carrier compound is a chelate.

53. A method according to claim 52, wherein the chemotherapeutic compound is covalently linked to a reactive carboxyl group of the chelate.

54. A method according to claim 42, wherein the chemotherapeutic compound is a taxane.

55. A method according to claim 54, wherein the taxane is paclitaxel.

56. A method according to claim 54, wherein the taxane is a paclitaxel analog.

57. A method according to claim 54, wherein the carrier is a gadolinium containing chelate.

58. A method according to claim 54, wherein the carrier compound is a tumor receptor ligand comprising said pre-selected element.

59. A method according to claim 42, wherein the transfer compound is selected to have a high rate of excretion by normal physiological processes.

60. A method according to claim 42, wherein the transfer compound is selected

for stability against dissociation of the pre-selected element time prior to substantially complete excretion or metabolism of the transfer compound.

61. A method according to claim 42, wherein the carrier compound is selected to have a high rate of excretion by normal physiological processes.

62. A method according to claim 42, wherein the carrier compound comprises said pre-selected element and the carrier compound is selected for stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the carrier compound.

63. A method according to claim 42, wherein an e-beam generated in the x-ray tube is focused on a thin target having a thickness of up to about 40 μm, said target being inside the tube and functions as part of the end window.

64. A method according to claim 63, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the K-absorption edge of the pre-selected element.

65. A method according to claim 64, wherein the thin target is selected from the group consisting of Sr, Ag, La, and Tm.

66. A method according to claim 63, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the L-absorption edge of the pre-selected element.

67. A method according to claim 66, wherein the thin target is Rb.

68. A kit for treating tumors or cancer in a human, which comprises:

(1) an x-ray tube having a target comprising a selected metal, said tube being capable of emitting monochromatic line emission x-rays; and

(2) a transfer compound which comprises a chemotherapeutic compound linked to a carrier compound by a bond or a bridging molecule, said carrier compound, bridging molecule or chemotherapeutic compound comprising a selected element,

the selected metal of said target and the selected element of said transfer compound being selected together:

(a) for said metal of said target to emit line emission x-rays having

an energy above and near the K-absorption edge or the L-absorption edge of the selected element of said transfer compound; and

(b) for said selected element of said transfer compound to release a dose of Auger electrons upon irradiation by said line emission x-rays.

69. A kit according to claim 68, wherein said x-ray tube is an end window transmission x-ray tube capable of emitting bright, line emission x-rays, said x-ray tube comprising an evacuated, elongated chamber having first and second ends, the first end being connected to a power supply, and within said chamber:

electron emitter means near the first end for generating a beam of electrons;

an end window transparent to x-rays at the second end, an inner portion of said end window comprising said target; and

means for focusing said electron beam on said target.

70. A kit according to claim 69, wherein the target has a thickness of up to about 40μm.

71. A kit according to claim 68, wherein the target is selected from the group consisting of Rb, Mo, Ag, La, Sr and Tm.

72. A kit according to claim 68, wherein the transfer compound is substantially non-toxic.

73. A kit according to claim 68, wherein the transfer compound has an affinity for both normal and cancerous cells.

74. A kit according to claim 73, wherein the transfer compound is substantially non-toxic.

75. A kit according to claim 68, wherein the transfer compound has a selective affinity for cancerous cells.

76. A kit according to claim 68, wherein the carrier compound is substantially non-toxic.

77. A kit according to claim 68, wherein the carrier compound has a selective affinity for cancerous cells.

78. A kit according to claim 77, wherein the carrier compound comprises a

tumor receptor ligand.

79. A kit according to claim 68, wherein the carrier compound is a complex of a ligand and said pre-selected element.

80. A kit according to claim 79, wherein the ligand is selected from the group consisting of 10-(2-hydroxy-propyl)-1,4,7,10-tetraazacyclododecane-1,4,7-triacetic acid, diethylenetriamine pentaacetic acid or diethylenetriamine pentaacetic acid bismethylamide.

81. A kit according to claim 68, wherein the carrier compound is a chelate.

82. A kit according to claim 81, wherein the chemotherapeutic compound is covalently linked to a reactive carboxyl group of the chelate.

83. A kit according to claim 68, wherein the chemotherapeutic compound is a taxane.

84. A kit according to claim 83, wherein the taxane is paclitaxel.

85. A kit according to claim 83, wherein the taxane is a paclitaxel analog.

86. A kit according to claim 83, wherein the carrier is a gadolinium containing chelate.

87. A kit according to claim 83, wherein the carrier compound is a tumor receptor ligand comprising said selected element.

88. A kit according to claim 68, wherein the selected element of the transfer compound has an atomic number in the range of from 35 to 79.

89. A kit according to claim 88, wherein the selected element of the transfer compound is selected from the group consisting of Br, Ru, I, Gd and Pt.

90. A transfer compound for use in treating cancer or tumors in a human, which comprises:

a chemotherapeutic compound linked to a carrier compound by a bond or a bridging molecule, said carrier compound, bridging molecule or chemotherapeutic compound comprising a pre-selected element; said pre-selected element being capable, when irradiated with line emission x-rays having a selected energy, of emitting Auger electrons in a dose effective to disrupt the linkage to said

chemotherapeutic compound.

91. A transfer compound according to claim 90, which is substantially non-toxic.

92. A transfer compound to claim 90, which has an affinity for both normal and cancerous cells.

93. A transfer compound according to claim 92, which is substantially non-toxic.

94. A transfer compound according to claim 90, which has a selective affinity for cancerous cells.

95. A transfer compound according to claim 90, wherein the carrier compound is substantially non-toxic.

96. A transfer compound according to claim 90, wherein the carrier compound has a selective affinity for cancerous cells.

97. A transfer compound according to claim 96, wherein the carrier compound comprises a tumor receptor ligand.

98. A transfer compound according to claim 90, wherein the carrier compound is a complex of a ligand and said pre-selected element.

99. A transfer compound according to claim 98, wherein the ligand is selected from the group consisting of 10-(2-hydroxy-propyl)-1,4,7,10-tetraazacyclododecane-1,4,7-triacetic acid, diethylenetriamine pentaacetic acid or diethylenetriamine pentaacetic acid bismethylamide.

100. A transfer compound according to claim 90, wherein the carrier compound is a chelate.

101. A transfer compound according to claim 100, wherein the chemotherapeutic compound is covalently linked to a reactive carboxyl group of the chelate.

102. A transfer compound according to claim 90, wherein the chemotherapeutic compound is a taxane.

103. A transfer compound according to claim 102, wherein the taxane is

paclitaxel.

104. A transfer compound according to claim 102, wherein the taxane is a paclitaxel analog.

105. A transfer compound according to claim 102, wherein the carrier compound is a gadolinium containing chelate.

106. A transfer compound according to claim 102, wherein the carrier compound is a tumor receptor ligand comprising said pre-selected element.

107. A transfer compound according to claim 90, wherein the pre-selected element has an atomic number in the range of from 35 to 79.

108. A transfer compound according to claim 107, wherein the pre-selected element is selected from the group consisting of Br, Ru, I, Gd and Pt.

109. A transfer compound according to claim 90, which when administered has a high rate of excretion by normal physiological processes.

110. A transfer compound according to claim 90, which when administered has stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the transfer compound.

111. A transfer compound according to claim 90, wherein the carrier compound, when released from the chemotherapeutic compound, has a high rate of excretion by normal physiological processes.

112. A transfer compound according to claim 90, wherein the carrier compound comprises said pre-selected element and the carrier compound, when released from the chemotherapeutic compound, has stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the carrier compound.

113. A transfer compound according to claim 90, wherein said effective dose is a dose of at least about 10^6 Gy.

114. A transfer compound according to claim 113, wherein said effective dose is a dose of at least about 10^6 Gy released within a distance from the pre-selected element of up to about 10 angstroms.

115. A method of treating tumors or cancer in a human in need of such treatment, which comprises:

(a) administering to the human a compound comprising a pre-selected element; and then

(b) irradiating a selected region, in which tumorous or cancerous cells are located, with line emission x-rays of an energy selected to cause emission of Auger electrons from said pre-selected element in a dose effective to disrupt intracellular components of said tumerous or cancerous cells.

116. A method according to claim 115, wherein said compound is rose bengal.

117. A method according to claim 115, wherein said intracellular components are lysosomes.

118. A kit for treating tumors or cancer in a human, which comprises:

(1) an x-ray tube having a target comprising a selected metal, said tube being capable of emitting monochromatic line emission x-rays; and

(2) a chemotherapeutic compound comprising a selected element,

the selected metal of said target and the selected element of said compound being selected together:

(a) for said metal of said target to emit line emission x-rays having an energy above and near the K-absorption edge or the L-absorption edge of the selected element of said compound; and

(b) for said selected element of said compound to release a dose of Auger electrons upon irradiation by said line emission x-rays.

119. A kit according to claim 118, wherein said compound is rose bengal.

120. A kit according to claim 118, wehrein said selected element is iodine.

121. A kit according to claim 120, wherein said target is lanthanum.